PATENT SPECIFICATION

922,454

Date of Application and filing Complete Specification: January 24, 1962. *No.* 2591/62

Application made in Germany (No. K42713X/39a) on January 24, 1961

Complete Specification Published: April 3, 1963

Index at Acceptance:—Class **87(2)**, A1G3B, A2(A4B:B2).

International Classification:—B29d.

COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Method and Apparatus for Producing Rubber Tubing

We, KOLNISCHE GUMMIFADEN - FABRIK VORMALS FERD, KOHLSTADT & Co., a German Limited Company, of 127-129 Deutz-Mulheimer Strasse, Koln-Deutz, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :—

The invention relates to a method of and apparatus for continuously producing a non-reinforced tubing of circular or slightly oval cross section containing over 50 percent by volume of vulcanised rubber.

The technologically conventional method of producing cross sectionally circular or only slightly oval highly elastic mechanically high quality unreinforced (principally thin-walled) tubing consists in forming the tubing continuously by a screw extruder, in then mounting the tubing discontinuously on tubular mandrels and in this condition vulcanising the stationary tubing by exposing it to hot air or superheated steam. This discontinuous and hence uneconomical process of vulcanisation was hitherto regarded as unavoidable because high grade rubber composition tubing with small admixtures of filler materials flow plastically when heated before they consolidate by being vulcanised. The tendency of the tubing to plastic flow causes the tubing leaving the screw extruder to be irreversibly deformed and to lose its circular section.

It has now been found that it is nevertheless possible to produce such a tubing in a continuous process if a vulcanising channel containing a revolving endless conveyor belt is provided adjacent the discharge end of the extruder and the speeds of the extruder and conveyor belt are matched, and if during the process of vulcanisation a small gauge pressure of air is maintained inside the tube. The necessary pressure can be provided by sending a current of air through the hollow mandrel of the tube extruder into the tubing which is open at one end.

The invention will now be described with reference to the accompanying drawings which illustrate preferred embodiments and in which :—

Fig. 1 is a schematic representation of an embodiment of apparatus for the continuous production of rubber tubing according to the invention and

Fig. 2 is a modification of a detail of the apparatus.

The apparatus illustrated in Fig. 1 comprises a tube extruder 1 with a nozzle 2 connected with a source of compressed air and containing a hollow perforated mandrel. Adjacent the exit of the extruder is a vulcanising belt 4 revolving in a heating chamber 3 and outside the chamber 3 is a cooling and delivery belt 5.

The length of the tubing thus obtained is limited by the length of the delivery belt 5. The belt 4 is equal in length to that of the chamber 3, and the belt 5 may be provided with cutting devices. Moreover, a straightening and control belt may be interposed between extruder 1 and vulcanising belt 4 and two rollers may be provided between the vulcanising belt 4 and the delivery belt 5. The two rollers serve to reduce temporarily the cross section of the tubing 6 and consequently to increase and regulate the pressure inside the tubing. The interposition of the two rollers is advisable, especially when tubing of an internal diameter greater than, say 50 mm, is to be produced by the described method. In such a case the maintenance of the required internal pressure would call for the supply of a disproportionately large volume of air if the two rollers were absent. The tubing cannot be deformed

[Price 4s. 6d.]

to any extent by the compression in the two rollers because the tubing has already been vulcanised before entering the rollers.

In the alternative form of construction shown in Fig. 2 a winding reel 7 is provided at the outlet end of the delivery belt 5 for winding the completed tubing thereon. The necessary internal pressure is adjusted preferably by pressure regulating means.

A partly continuous method of production may be performed by leaving the tubing open at one end during the extruding and vulcanising processes. An excess of air will then be blown through the tubing. After having been deposited on a length of delivery belt the tubing is then cut to lengths, the maximum length depending upon the length of the delivery table.

The vulcanisation time depends upon the length of the vulcanising belt and the speed of the belt. If the vulcanisation time is long, the temperature of vulcanisation may be low and the risk of accidental permanent deformation of the tubing can be kept low. On the other hand, the efficiency of the method increases as working speeds rise by shortening the vulcanising time. It is therefore an advantage to reduce the intermediate plastification time of the composition by making additions of suitable rigidifying additives, such as factice, regenerate, synthetic rubber or active silicic acid or silicates. In carrying out the invention the total proportion of all additions should not exceed 50 percent by volume. It is also advisable to accelerate the response of the mixture by the nature and quantity of the vulcanising accelerator. However, the possible increase in the quantity of vulcanising accelerator that can be added is subject to limitation because of the necessity of preventing partial vulcanisation of the composition during the mixing process itself.

Tubing produced in the manner described is particularly suitable for further processing into packing and stocking rings. Tubing intended for such purposes has wall thicknesses between 1 and 2 mm or less, and an internal diameter between 10 and 100 mm or more.

WHAT WE CLAIM IS:—

1. A method of producing tubing of circular or only slightly oval cross section from a material containing 50 per cent or over, by volume, unvulcanized (natural or synthetic) rubber, wherein the tubing formed by an extruding machine is immediately conducted through a heating chamber on a conveyor belt to vulcanize the tubing, and its approximately circular section is retained during vulcanization by the maintenance of a slight gauge pressure in its interior.

2. Method as claimed in claim 1, wherein the free end of the tubing is kept closed whilst its internal pressure is kept constant by fine regulation.

3. A method as claimed in claim 1, wherein the tubing remains open at one end during the extruding and vulcanizing steps, a slight gauge pressure being maintained therein by blowing in air, the tubing being deposited on a delivery belt and being cut into lengths.

4. Apparatus for performing the method claimed in claims 1 to 3, comprising a tube extruder which delivers the extruded tubing into a heating chamber containing a conveyor belt equal in length to the length of the heating chamber and upon which the tubing is conveyed, means for supplying air for maintaining a slight gauge pressure in the interior of the extruded tubing within the heating chamber, a cooling and delivery means, preferably in the form of a conveyor belt, being provided outside the heating chamber and carrying cutting devices for dividing the tubing into predetermined lengths.

5. Apparatus as claimed in claim 4, wherein a reel is provided at the end of the cooling and delivery belt on which the tubing may be wound.

6. Apparatus as claimed in claims 4 and 5, wherein a pair of rollers are provided between the vulcanizing belt and the delivery belt.

7. A method of producing tubing of circular or slightly oval cross section substantially as hereinbefore described.

8. Apparatus for carrying out the method of producing tubing as herein set forth substantially as described with reference to the accompanying drawing.

STEVENS, LANGNER, PARRY & ROLLINSON,
Chartered Patent Agents,
Agents for the Applicants.

Berwick-upon-Tweed: Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd.—1963
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2, from which copies may be obtained.

922,454 COMPLETE SPECIFICATION
1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

Fig. 1

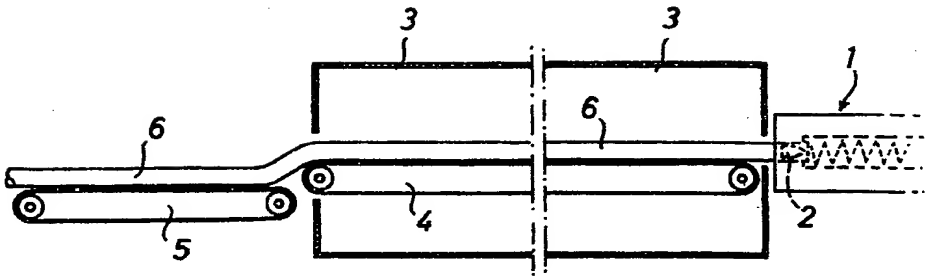

Fig. 2